# Empirical Analysis of Workers' Mental Health

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ABSTRACT OF THE DISSERTATION

This dissertation explores the relationship between mental health and working from an economics perspective. The study has three purposes. First, to find the magnitude of labor loss in foreign countries caused by mental health problems via a literature review. Second, to estimate the extent of labor loss, particularly in income change rates of workers with mental disorders in Japan. Third, to explore how to work to improve mental health by focusing on working flexibility and long working hours.

In Chapter 1, I review empirical literatures related to the effects of mental health problems on the outcome of labor market, focusing on labor supply, productivity, and income. The number of people suffering with mental problems is increasing, and the social burden of mental disorders is also more significant. This chapter summarizes the methods using data, empirical results, and limitations, to quantify the social burden.

In Chapter 2, I estimate the effects of mental health on income using Japanese micro data based on the review of the Chapter 1. Specifically, the income function is estimated with an instrumental variable considering endogeneity. According to the estimation results, it is found that the income change rates caused by mental health problems and mental disorders in Japan is much higher than those in foreign countries.

In Chapter 3, I examine the impacts of working on mental health problems by focusing on working flexibility and long working hours. Recently, a stress check of employees has been imposed, and it is recognized as an important policy issue, specifically the work style reform by the Japanese government. According to estimation results using cross-sectional data, the length of working hours does not necessarily have a negative impact on mental health, and self-employed workers who have flexibility have a positive impact on mental health.

In Chapter 4, I attempt to improve analytical methods to address some remaining issues in the Chapter 3. A panel data is used to address the issue of endogeneity. I confirm how the mental health function differs depending on working flexibility. Results indicate that for workers who have flexibility, the longer the working hours, the better their mental health, but mental health lowers when working hours exceed its optimal value. Conversely, for workers who lack flexibility, the longer the working hours, the worse their mental health. I find that there are non-linear relationships between working hours and mental health.

Chapter 1

# How Do Mental Health Problems Affect Labor Market Outcomes? Empirical Studies Review

***JEL classification:*** I18, J21, J24

***Background and Aims of the Study:*** The study's purpose of this chapter is to investigate the effect of mental health problems and mental disorders on outcomes of the labor market by a literature survey. In Japan, the number of patients with mental disorders is increasing and suicide is the most common cause of death among young or middle-aged people. Workers with mental health problems have lower rates of receiving medical treatment than other in countries. This indicates that the patient's quality of life lowers and social burdens of mental disorders increase through a decline in labor supply and productivity. However, it is difficult to quantify the decline of labor productivity objectively, and there are unavailable data in Japan. Therefore, most studies were conducted using the rate of decline obtained from research in Western countries or arbitrarily assumed to be 50%. It is problematic that these are not appropriate to represent the actual effects on mental health in Japan.

***Methods:*** The literature review on the effect of mental health problems and mental disorders on the labor market is conducted to examine what and how should be measured as an indicator on the labor loss. From the perspective of data, estimation method, results, and issues in the future, previous studies in foreign countries are widely surveyed. In particular, it is arranged in three points of labor supply, labor productivity, and income.

***Results:*** A literature survey shows the common results that mental health problems and mental disorders significantly reduced labor supply, labor productivity, and income. In contrast, I also find that the rate of decline is greatly different by country and ethnicity. In addition, it is found that those who have mental disorders during adolescence have about 18% lower future income, and those who attempt suicide have about 53% lower income after suicide attempt than healthy workers.

***Conclusions and Discussion:*** Difference in the decline rates of the labor market outcome may be caused by employment environments and attitude to work in each countries. Therefore, it is necessary to prepare original objective data to analyze the effect of mental health on the labor market in Japan. The rate of taking paid holidays is low, and many workers feel guilty about taking days off from work. Such an environment perhaps increases the magnitude of labor loss. Many studies which show the economical factor of suicide are reported, conversely, the objective evidence that the suicide attempt caused an economic disadvantage in the future is found. There is a need for more extensive studies in Japan, where the suicide rate of the young generation is high.

Chapter 2

# To What Extent Do Mental Health Problem Decrease Income in Japan? An Estimation of Income Change Rate

***JEL classification:*** C36, I18, J24

***Background and Aims of the Study:*** This study conducts an empirical analyses to estimate the effects of mental health problems and mental disorders on income. In the literature review of the Chapter 1, I find that mental health problems and mental disorders have negative effects on labor supply, labor productivity, and income in foreign countries. However, there is limited research in this field in Japan, and we need an analysis using objective and comprehensive data. I reveal the extent to which workers with mental health problems receive less income as compared to healthy workers.

***Methods:*** Using anonymous data of the *Comprehensive Survey of Living Conditions* in 2007, I estimate income functions using the mental health indicators as dependent variables. As mental health indicators, K6 dummy (over 13 points, over 10 points, and over 5 points) and mental disorder dummy are used. In addition, empirical analyses are conducted using the instrumental variable (IV) to identify the direction of causality. I use a consultation dummy about whether workers are discussing their problems with someone as the IV.

***Results:*** Descriptive statistics show that only 1% of workers receive medical treatment for mental disorders, and 2.6% of the workers score over 13 points of K6. Additionally, only 11.5% of workers with K6 over 13 points receive treatment for mental disorder. These results indicate that many with mental health problems work without medical care for the mental disorders. According to estimation results, it is found that mental health problems and mental disorders have a significant negative impact on income. More importantly, workers with a score of 10 or higher in K6 have 35.5% lower household income and 57.4% lower personal income than those with a score of 10 or lower in K6, workers with a score of 13 or higher in K6 have 67.7% lower household income and 77.0% lower personal income than those with a score of 13 or lower in K6, and outpatients with mental disorders have 82.8% lower household income and 93.6% lower personal income (Table Ⅰ, Ⅱ). Statistical tests indicate the validity of estimates by IV method rather than the ordinary least squares method.

***Conclusions and Discussion:*** This study measures the magnitude of labor loss caused by mental health problems using Japanese micro data. I find that the workers with mental health problems or mental disorders have significantly lower incomes than healthy workers, even if endogeneity is excluded. The rate of income decline in Japan is also much larger than that in foreign countries reported in the literature review. In the future, the use of panel data to improve robustness of the estimation results is suggested.

Table Ⅰ. Estimation Results of Household Income Function

| Dependent Variable: Log of Household Income | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| K6 over 5 Dummy (=1) | -0.134 ** | | | |
| K6 over 10 Dummy (=1) | | -0.438 ** | | |
| K6 over 13 Dummy (=1) | | | -1.131 ** | |
| Mental Disorder Dummy (=1) | | | | -1.760 ** |
| Gender Dummy (Male=1) | -0.028 | -0.026 | -0.029 | -0.032 |
| Age 20-29 Dummy (=1) | 0.185 *** | 0.191 *** | 0.187 *** | 0.171 *** |
| Age 30-39 Dummy (=1) | 0.074 ** | 0.080 ** | 0.075 ** | 0.076 ** |
| Age 40-49 Dummy (=1) | 0.044 | 0.048 | 0.043 | 0.031 |
| Age 50-59 Dummy (=1) | 0.082 *** | 0.085 *** | 0.082 *** | 0.077 *** |
| Marital Status Dummy (Married=1) | 0.153 *** | 0.146 *** | 0.135 *** | 0.143 *** |
| Household Size | 0.092 *** | 0.091 *** | 0.092 *** | 0.094 *** |
| With Child under 6-Years Old Dummy (=1) | -0.129 *** | -0.129 *** | -0.132 *** | -0.139 *** |
| Number of Workers in Household | 0.164 *** | 0.165 *** | 0.162 *** | 0.161 *** |
| Non-Regular Employment Dummy (=1) | -0.094 *** | -0.086 *** | -0.090 *** | -0.106 *** |
| Years of Working Experience | 0.016 *** | 0.017 *** | 0.017 *** | 0.015 *** |
| Years of Working Experience Squared | 0.000 *** | 0.000 *** | 0.000 *** | 0.000 *** |
| Working Hours (per week) | 0.001 ** | 0.001 ** | 0.001 * | 0.001 |
| Borrowing Dummy (=1) | 0.138 *** | 0.139 *** | 0.143 *** | 0.143 *** |
| Stockholding Dummy (=1) | 0.299 *** | 0.296 *** | 0.296 *** | 0.304 *** |
| Company Size Dummy (=1) | | | | |
| Under 300 Employees | 0.023 | 0.017 | 0.025 | 0.009 |
| 300-999 Employees | 0.092 *** | 0.082 *** | 0.082 *** | 0.076 ** |
| Over 1,000 Employees | 0.160 *** | 0.158 *** | 0.161 *** | 0.156 *** |
| Occupational Classification Dummy (=1) | | | | |
| Specialist Professionals | 0.111 ** | 0.113 ** | 0.083 | 0.137 ** |
| Administrative and Managerial Workers | 0.274 *** | 0.269 *** | 0.238 *** | 0.303 *** |
| Clerical Workers | 0.145 *** | 0.154 *** | 0.132 ** | 0.163 *** |
| Sales Workers | -0.043 | -0.044 | -0.066 | -0.015 |
| Service Workers | -0.111 ** | -0.099 * | -0.129 ** | -0.100 * |
| Security Workers | 0.129 | 0.107 | 0.080 | 0.169 * |
| Agriculture, Forestry and Fishery Workers | -0.276 *** | -0.266 *** | -0.287 *** | -0.266 *** |
| Transport Workers | -0.081 | -0.077 | -0.100 | -0.076 |
| Manufacturing Process Workers | -0.067 | -0.065 | -0.093 | -0.043 |
| Constant | 5.311 *** | 5.306 *** | 5.343 *** | 5.310 *** |
| Observations | 4,915 | 4,915 | 4,915 | 4,855 |
| Adjusted R-Squared | 0.327 | 0.308 | 0.266 | 0.278 |
| F-value | 86.56 | 83.98 | 77.78 | 79.29 |
| Hausman Test (p-value) | 0.23 | 0.07 | 0.03 | 0.04 |
| First-stage F-value | 415.09 | 96.34 | 39.05 | 44.88 |

Source: Author's estimation based on MHLW (2007) "Comprehensive Survey of Living Conditions".
Notes:
1. * significant at 10%; ** at 5%; *** at 1%.
2. Estimation model is IV method.
3. Income is presented in a log of annual income.

Table Ⅱ. Estimation Results of Personal Income Function

| Dependent Variables: Log of Personal Income | (5) | (6) | (7) | (8) |
|---|---|---|---|---|
| K6 over 5 Dummy (=1) | -0.326 ** | | | |
| K6 over 10 Dummy (=1) | | -0.854 ** | | |
| K6 over 13 Dummy (=1) | | | -1.471 ** | |
| Mental Disorder Dummy (=1) | | | | -2.742 * |
| Gender Dummy (Male=1) | 0.109 ** | 0.098 * | 0.095 | 0.104 * |
| Age 20-29 Dummy (=1) | 0.049 | 0.084 | 0.061 | -0.002 |
| Age 30-39 Dummy (=1) | 0.138 ** | 0.172 ** | 0.143 * | 0.152 * |
| Age 40-49 Dummy (=1) | 0.094 | 0.142 * | 0.075 | 0.058 |
| Age 50-59 Dummy (=1) | 0.061 | 0.079 | 0.047 | 0.039 |
| Marital Status Dummy (Married=1) | 0.225 *** | 0.253 *** | 0.239 *** | 0.231 *** |
| Household Size | 0.088 *** | 0.080 *** | 0.090 *** | 0.081 *** |
| With Child under 6-Years Old Dummy (=1) | -0.240 *** | -0.235 *** | -0.257 *** | -0.247 *** |
| Non-Regular Employment Dummy (=1) | -0.293 *** | -0.235 *** | -0.248 *** | -0.297 *** |
| Years of Working Experience | 0.028 *** | 0.029 *** | 0.029 *** | 0.027 *** |
| Years of Working Experience Squared | -0.001 *** | -0.001 *** | -0.001 *** | 0.000 *** |
| Working Hours (per week) | 0.003 ** | 0.003 *** | 0.003 ** | 0.003 ** |
| Borrowing Dummy (=1) | 0.093 ** | 0.074 * | 0.079 ** | 0.128 *** |
| Stockholding Dummy (=1) | 0.303 *** | 0.299 *** | 0.294 *** | 0.331 *** |
| Company Size Dummy (=1) | | | | |
| Under 300 Employees | 0.009 | 0.016 | 0.033 | -0.012 |
| 300-999 Employees | 0.123 ** | 0.118 * | 0.142 ** | 0.113 * |
| Over 1,000 Employees | 0.238 *** | 0.234 *** | 0.234 *** | 0.225 *** |
| Occupational Classification Dummy (=1) | | | | |
| Specialist Professionals | 0.013 | -0.017 | -0.049 | 0.120 |
| Administrative and Managerial Workers | 0.251 ** | 0.202 * | 0.162 | 0.306 *** |
| Clerical Workers | 0.156 | 0.127 | 0.074 | 0.231 ** |
| Sales Workers | -0.055 | -0.090 | -0.110 | 0.052 |
| Service Workers | -0.222 ** | -0.250 ** | -0.293 ** | -0.153 |
| Security Workers | 0.137 | 0.036 | 0.028 | 0.315 * |
| Agriculture, Forestry and Fishery Workers | -0.303 ** | -0.329 ** | -0.380 ** | -0.251 |
| Transport Workers | -0.071 | -0.098 | -0.119 | -0.013 |
| Manufacturing Process Workers | -0.126 | -0.156 | -0.193 | -0.049 |
| Constant | 5.274 *** | 5.250 *** | 5.280 *** | 5.172 *** |
| Observations | 1,232 | 1,232 | 1,232 | 1,218 |
| Adjusted R-Squared | 0.412 | 0.356 | 0.324 | 0.318 |
| F-value | 34.37 | 30.63 | 28.67 | 27.74 |
| Hausman Test (p-value) | 0.07 | 0.03 | 0.02 | 0.04 |
| First-stage F-value | 84.92 | 27.95 | 22.92 | 15.45 |

Source: Author's estimation based on MHLW (2007) "Comprehensive Survey of Living Conditions".
Notes:
1. * significant at 10%; ** at 5%; *** at 1%.
2. Estimation model is IV method.
3. Income is presented in a log of annual income.

Chapter 3

# Does Flexible Working Improve Mental Health? A Perspective Type of Employment and Long Working Hours

***JEL classification:*** C31, I31, J81

***Background and Aims of the Study:*** The purpose of this study is to indicate the impacts of working flexibility and long working hours on mental health. The type of employment is used as a proxy indicator to reflect working flexibility. This study's hypothesis is that mental health can be improved by working flexibility enabling workers to choose when, where, with whom and how to work. The relationship between working and physical health is a close, but, clear causal relationship between mental health and work conditions, particularly type of employment, has not been consistently confirmed in previous studies (Virtanen et al.,2001; Benach et al., 2004; Seto et al., 2006; Andersson, 2008; Tuttle and Garr, 2009; Matsuyama,2010; Takahashi et al., 2014). I consider that the effects of working hours on mental health differ according to the type of employment, and even if temporary long working hours occur, mental health does not always deteriorate when workers have flexibility.

***Methods:*** I analyze by ordered logit model using 2010 cross-sectional data from *Japanese General Social Surveys* (JGSS). I estimate mental health functions with working hours as a dependent variable by three types of employment; regular employment, non-regular employment, self-employed. I use subjective happiness and subjective depression as mental health indicators.

***Results:*** Self-employed men (workers who have flexibility) have no negative impact on mental health and have higher subjective happiness, even if they work longer hours. In contrast, for men in regular and non-regular employment and women in regular employment, working hours significantly decline subjective happiness. The negative effect is greater for non-regular employees than for regular employees (Table Ⅲ and Ⅳ). These results are consistent with the hypothesis.

***Conclusions and Discussion:*** These results suggest that the effect of working hours on mental health depends on working flexibility and that long working hours may not worsen mental health when workers have flexibility. As a result of this study, it is necessary to deregulate the upper limit on long working hours together with a system to increase flexibility and diversity of working styles. It is the most important viewpoint in securing health in the medium and long term to determine the optimal way of working according to life cycle, while paying attention to long working hours that damage health.

Table Ⅲ. Estimation Results of Subjective Happiness for Male

| | Regular Employment | Non-regular Employment | Self-employed |
|---|---|---|---|
| Working Hours (per week) | -0.018 *** | -0.031 *** | 0.013 * |
| | (0.005) | (0.012) | (0.008) |
| Annual Income | 0.000 | 0.000 | 0.000 |
| | (0.000) | (0.001) | (0.000) |
| Years of Working Experience | -0.009 | 0.007 | -0.006 |
| | (0.007) | (0.016) | (0.009) |
| Age | -0.021 *** | -0.023 * | 0.010 |
| | (0.007) | (0.013) | (0.014) |
| Marital Status Dummy (Married=1) | 1.646 *** | 1.602 *** | 0.776 * |
| | (0.175) | (0.466) | (0.441) |
| Working Hours×Housework Dummy | 0.001 | 0.007 | -0.004 |
| | (0.003) | (0.011) | (0.008) |
| Subjective Physical Health Dummy (=1) | 1.111 *** | 1.044 *** | 0.415 |
| | (0.179) | (0.372) | (0.329) |
| Observations | 860 | 161 | 187 |
| R-squared | 0.072 | 0.070 | 0.017 |

Source: Author's estimation based on the JGSS Research Center (2010) "Japanese General Social Surveys".
Notes:
1. * significant at 10%; ** at 5%; *** at 1%.
2. Subjective happiness indicates that the higher the score, the higher the mental health condition.
3. Housework dummy is presented in 1 if prepared dinner more than several times a week, and 0 otherwise.

Table Ⅳ. Estimation Results of Subjective Happiness for Female

| | Regular Employment | Non-regular Employment | Self-employed |
|---|---|---|---|
| Working Hours (per week) | -0.021 ** | 0.004 | 0.890 |
| | (0.010) | (0.011) | (52.566) |
| Annual Income | 0.003 *** | 0.000 | -0.002 |
| | (0.001) | (0.001) | (0.001) |
| Years of Working Experience | -0.003 | -0.008 | 0.050 *** |
| | (0.013) | (0.013) | (0.019) |
| Age | -0.044 *** | -0.009 | -0.031 |
| | (0.010) | (0.007) | (0.023) |
| Marital Status Dummy (Married=1) | 0.572 *** | 0.414 * | 0.184 |
| | (0.218) | (0.213) | (0.481) |
| Working Hours×Housework Dummy | 0.008 | -0.009 | -0.916 |
| | (0.005) | (0.009) | (52.566) |
| Subjective Physical Health Dummy (=1) | 0.711 *** | 0.973 *** | 1.532 *** |
| | (0.238) | (0.234) | (0.598) |
| Observations | 437 | 580 | 78 |
| R-squared | 0.059 | 0.018 | 0.130 |

Source: Author's estimation based on the JGSS Research Center (2010) "Japanese General Social Surveys".

Notes:

1. * significant at 10%; ** at 5%; *** at 1%.
2. Subjective happiness indicates that the higher the score, the higher the mental health condition.
3. Housework dummy is presented in 1 if prepared dinner more than several times a week, and 0 otherwise.

Chapter 4

# The Effects of Working Flexibility and Long Working Hours on Mental Health : Using Panel Data

***JEL classification:*** C33, I31, J81

***Background and Aims of the Study:*** This chapter attempts to improve the analytical methods to address some remaining issues from the Chapter 3. The survey used in the previous chapter discussed type of employment as a proxy indicator of working flexibility, however, I confirm the direct impact of working flexibility on working hours in this chapter. In addition, to analyze nonlinear relations in detail, models of logarithmic and quadratic functions are specified. In the previous chapter, a linear relationship between working hours and mental health was found, however, no one can continue to work indefinitely without rest. It is physiologically plausible to assume that mental health worsens or at least does not further improve, after a certain number of working hours. Moreover, I use panel data to address the issue of endogeneity.

***Methods:*** I estimate mental health functions by a fixed effects model and a random effects model using 2009 and 2013 panel data from JGSS. The data is analyzed in two subgroups: One group has the ability to decide the amount of work at their own discretion, while the other group cannot. I use the five-item version of the Mental Health Inventory (MHI-5) as a mental health indicator that measures depression more accurately with fewer questions. The model is specified by the Hausman test.

***Results:*** For the groups with working flexibility, logarithmic values of working hours has a significant positive effect on mental health. Conversely, for the group lacking working flexibility, logarithmic value of working hours has a significant negative effect on mental health. Additionally, for the group with working flexibility, working hours have a significant positive effect on mental health and the working hours squared have a significant negative effect. The result is a quadratic function convex upward. In contrast, for the group lacking working flexibility, the working hours and working hours squared do not have a statistically significant effect on mental health (Table Ⅴ).

***Conclusions and Discussion:*** Results show that the effects of working hours on mental health vary depending on working flexibility. For many workers who have flexibility, the longer their working hours, the better their mental health. There is, however, a limit to this, it found that mental health deteriorates when working hours exceed 89.3 hours per week.Conversely, for workers without flexibility, the longer their working hours, the worse their mental health. This result is almost consistent with the findings shown in the Chapter 3.

Table Ⅴ. Estimation Results of Mental Health Function
(By Working Flexibility Dummy)

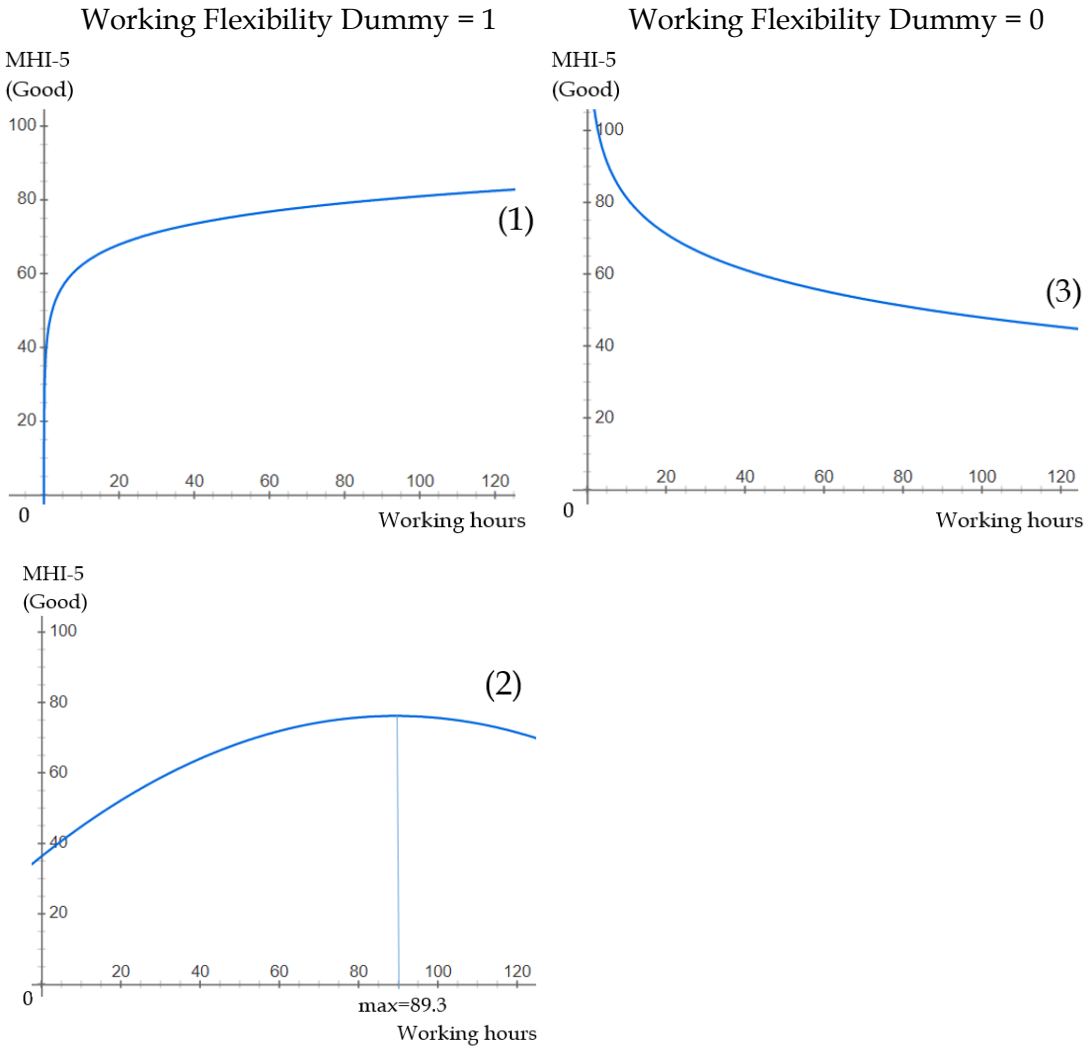
| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Dependent Variable:Mental Health | Dummy = 1 | Dummy = 0 | Dummy = 1 | Dummy = 0 |
| Log of Working Hours | 8.134 ** | -14.476 ** | | |
| | (3.875) | (6.597) | | |
| Working Hours | | | 0.893 ** | -0.044 |
| | | | (0.385) | (0.255) |
| Working Hours Squared | | | -0.005 * | -0.001 |
| | | | (0.003) | (0.003) |
| Wage | -0.946 | -2.637 | 4.627 | -0.287 |
| | (2.831) | (3.172) | (3.681) | (1.434) |
| Age | -0.082 | -0.088 | -0.041 | -0.214 |
| | (0.390) | (0.427) | (0.421) | (0.231) |
| Marital Status Dummy (Married=1) | -7.394 | 7.671 | -6.950 | 2.795 |
| | (6.222) | (5.495) | (6.585) | (2.184) |
| Year Dummy (2009=1) | | | | 0.458 |
| | | | | (1.683) |
| Industry Dummy - Construction (=1) | 8.509 | -2.023 | 7.828 | 4.340 |
| | (9.008) | (9.186) | (10.519) | (3.830) |
| Industry Dummy - Manufacture (=1) | -17.368 ** | 8.210 | -11.522 | 0.088 |
| | (6.848) | (6.020) | (8.107) | (2.468) |
| Industry Dummy - Wholesale and Retail Trade (=1) | -10.357 | -12.788 | -7.452 | 5.114 |
| | (6.375) | (8.108) | (8.780) | (3.114) |
| Occupation Dummy - Specialist Professionals (=1) | 14.380 ** | 5.069 | 14.388 *** | 1.476 |
| | (5.796) | (6.715) | (5.392) | (2.569) |
| Occupation Dummy - Clerical workers (=1) | 7.156 | -9.552 | 6.254 | 3.109 |
| | (4.524) | (5.986) | (4.436) | (2.452) |
| Occupation Dummy - Service workers (=1) | 3.941 | -4.371 | 3.598 | 1.840 |
| | (6.475) | (8.184) | (6.951) | (3.727) |
| Occupation Dummy - Transport workers (=1) | 2.025 | 9.165 | 3.479 | -1.029 |
| | (11.542) | (8.932) | (11.727) | (4.937) |
| Constant | 43.487 ** | 114.613 ** | 36.608 * | 67.086 *** |
| | (20.279) | (27.737) | (21.563) | (11.863) |
| Observations | 415 | 589 | 383 | 538 |
| R-squared (within) | 0.219 | 0.087 | 0.231 | 0.000 |
| Model | FE | FE | FE | RE |

Source: Author's estimation based on the JGSS Research Center (2009, 2013) "Japanese General Social Surveys".

Notes:

1. * significant at 10%; ** at 5%; *** at 1%.
2. Mental health is measured by MHI-5 (five items version of the Mental Health Inventory).
3. Wage is presented in units of JPY one thousand and per hour.
4. Year dummy is not included in estimation by fixed effects model because a relationship of collinearity between year dummy and age exists.
5. The estimation is conducted by a fixed effects model (FE) and a random effects model (RE). The model is specified by Hausman test.

Figure Ⅰ. Mental Health Function




Source: Author's estimation based on the JGSS Research Center (2009, 2013) "Japanese General Social Surveys".

Notes:

1. The vertical axis is mental health and the horizontal axis is working hours per week.
2. Mental health is measured by MHI-5 (five-item version of the Mental Health Inventory). The higher the score, the better the mental health.
3. The model for my estimation is as follows: $MH_{iy} = \alpha_{iy} + \beta \log t_{iy} + \sigma X_{iy} + \lambda_i + \varepsilon_{iy}$ and $MH_{iy} = \alpha_{iy} + \gamma t_{iy} + \delta t_{iy}^2 + \sigma X_{iy} + \lambda_i + \varepsilon_{iy}$. MH represents mental health, i denotes the respondent number, y denotes the year, β, γ, δ, and σ are coefficient vectors, λ is respondent fixed effects, $\log t$ is a log of working hours, t is working hours, $t^2$ is working hours squared, X is the set of control variables and ε is an error term.
4. The data is analyzed in two subgroups: One group has the ability to decide the amount of work at their own discretion, and the other group cannot.
5. Result (1) for the group with working flexibility indicates that the log of working hours has a significant positive effect on mental health at 5%. Additionally, result (2) for the group with working flexibility indicates that working hours have a significant positive effect at 5% and the working hours squared have a significant negative effect on mental health at 10%. Conversely, result (3) for the group without working flexibility indicates that the log of working hours has a significant negative effect on mental health at 5%, and a quadratic function does not have a statistically significant effect.